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## FORENSIC ANALYSIS IN ENVIRONMENTAL CRIMES

### *Abstract*

*Environmental crime signifies the crime which is well represented in the overall crime rates, however its dark number is significant. Population or citizens aren't enough educated and also do not have high level of awareness to recognize and at the same time report environmental crimes. Therefore it is of the utmost importance that the discovered environmental crimes are proven and that the adequate sanction are imposed to the perpetrators. The methodology of investigating environmental crimes implies conducting a significant numbers of operative-tactical actions and investigative measures that can ensure gathering evidence of environmental crime within the criminal investigation frames. Forensic analysis is of particular importance for environmental crime investigation, where application of this analysis can provide material evidence for courts. First of all, this refers to the situational field expertise, onsite inspection or insight at the place of the event, as well as laboratory expertise on traces found at the crime scene. The authors of this paper analyze the measures and activities applied by the competent authorities, such as police and inspection bodies, and elaborate certain actions and processes regarding the forensic analysis.*

*Key words: environmental crime, investigate measures, expertise, forensic analysis, etc.*

## **1. INTRODUCTION**

During inspection or expertise in criminal acts, it should be considered that there is a fast-changing situation at the scene which is determined by many factors. Therefore, there is a danger of losing existing traces and items. Because of this it is difficult to secure and preserve the quality of data and physical evidence that would clarify and prove that a crime was committed. (Dzukleski, G. 2006, 77). To avoid this, it is necessary to perform situational expertise that would lead to reduction in the usual lack of information. Of great importance, while conducting situational expertise, is the necessary criminal-technical equipment consisting of mobile laboratories. Thus, the vehicle appears as part of the laboratory operating equipment, with sets of laboratory and supporting technical tools. This mobile, operational laboratory must also be prepared to perform forensic expertise at the crime scene. It must contain equipment for comparative researches and analyse. The head inspector and the experts should be equipped with technical tools for criminal investigation. These tools consist of general and special kits containing photo equipment for making working plans. Range of technical general crime equipment also includes, photo pack and special selection of chemical reagents. There is a need of special mobile crime lab, equipped with a wide range of technical equipment used for analysing and appliances for comparative studies and etc. Situational analysing is performed by advanced operational and investigative equipment and protective equipment that provides simple operating devices, suitable for sampling and providing clues and evidence. Applying certain methods can save time and give more efficient performance in conducting the expert evidence. (Sazdovska M. M., Oklevski S., 2014).

Characteristic of environmental crimes is the sophisticated way of execution of the crime, but also the connection with other criminal behavior. Thus, environmental crime is linked to committing other offenses as abuse of official position, counterfeiting, terrorism financing and etc. In order to successfully combat this kind of crime requires forensic analysis and adequate equipment (Sazdovska M. M., Arminoski V., 2016).

## **2. CRIME SCENE INVESTIGATION**

Criminal investigator and the public prosecutor may order the forensic expertise during the execution of the inspection. Then criminal investigator can formulate questions together with the experts, which actually provides more advantages. Here, a regulation should be made or, at least, a recommendation, because in complex situations inspection team should work together with an appropriate team of experts lead by a situational expert. In criminal procedural law textbooks and criminology textbooks, a relations set between the criminal investigators, the public prosecutor and the criminal expert, so that the first two

are obliged to submit all materials needed for the expertise to the expert. Expert witness is away from detecting and collecting material phase and gives only his opinion about the material that he was given. This concepts different: besides the traditional approach, in complex cases forensic experts should participate on the crime scene early in the phase of discovery, fixing the actual evidence, and performing situation analysis. There are such expertise materials that can be detected and fixed only with an expert working at the crime scene (Sazdovska M. M., 2007). Physical evidence is of great importance (at the scene and away from it) for the scene as a system. But that evidence should be discovered with versatility and legeartis, fixed and interpreted. Otherwise is not possible. It requires situational examination, expert evidence immediately after the dynamic phase of the inspection. Without this, the expertise can't be done later, because there is lack of information as a result of the inevitable rapid changes at the scene. In practice a high degree of really qualified scientific forensics should be applied. Science is not what is done in the laboratory. It must be performed at the scene. Another forensic expert Hans Gross emphasized capital importance of crime scene as the most important source of physical evidence. There are many clues and traces so the criminal expertise should be advanced towards performing criminal expert evidence at the crime scene (Sazdovska M. M., 2009).

### **3. FORENSIC EXPERT**

Forensic Experts are experts who can make certain observations, thanks to their knowledge, skills and experiences and leaning on these basis, they draw best conclusions. The expert should prepare the correct material, which he analyses and for which he makes conclusions that are further used in the procedure: he will participate several times in the already prepared expert material. This will be the case when locating, selecting and packaging expert materials requires special expertise (Vodinelić, V., 1978: 206). It takes a sovereign knowledge of the criminalistics so that the expert can be used, to know what, when and how the expert is asked. The use of the expert would be much more successful if the perpetrators know exhaustively what everything can be learned from the expert. Forensic experts are experts from various profiles, such as assessors, craftsmen, doctors, bookkeepers, foresters, forensics, biologists, physicists, chemists, biochemists, etc. In the important criminal processes, the experts play a key, even decisive role. Some cases remain unclear, although with the help of expert assistants, the objective existence of the offense and the criminal responsibility of the perpetrator could be determined. In order for the expert to act successfully, he should be fully informed with all the evidence, because he is a collaborator in the procedure and in his work he is using scientific methods and is able to provide correct expertise only if he knows the circumstances and their mutual connection (Latifi, 2018: 220).

The expert must be skillful in applying the principles and techniques of the physical and natural sciences in analyzing the many types of evidence that can be obtained during a criminal investigation. However, the expert must also be aware of the needs and constraints imposed by the judicial system. The procedures and techniques used in the laboratory must not only be based on firm scientific background, but also to meet the eligibility criteria established by the courts (Saferstein, R., 2010: 16).

The expert often helps to the criminal prosecutors in collecting the material for expertise, but in environmental crimes, forensic expert himself takes the samples as a reason for the prompt reaction in time and providing sufficient material evidence, which preserves the samples and transports them to the laboratory for further detailed expertise (Latifi, L. & Oklevski, S., 2015).

#### **4. SAMPLING DURING FORENSIC EXPERTISE**

Any object, trace or impression that can provide information about the incident under investigation is the subject of physical evidence. This section examines the main principles involved in the quest for the collection, packaging, labeling and storage for such items. The supportive principles involved in the search and dealing with objects of physical evidence are the same, regardless from the work being investigated (Jackson, R.W.A. & Jackson, M.J., 2009: 17).

What is most important during sampling of environmental crimes should be the location of the criminal event, i.e. the “ecological dimension of pollution”, which facilitates further work and begins with the application of protocols, standard operating procedures, sampling techniques, methods of sampling their preservation and transporting the samples (Latifi, L., Sazdovska, M.M., & Troshanski, S., 2015).

Proper sampling for environmental crimes is important for the following reasons:

1. Properly taken sample gives accurate results.
2. Correct pollution results imply credible evidence of environmental crime.
3. The application of check lists and standard operating procedures removes any obstruction or error in sampling or conservation of the sample.
4. Knowing all relevant facts about the scene, the medium being analyzed, the reasons and the motives for the criminal act, and possession of the correct results are in order to successfully record the material evidence and their successful presentation to the judicial authorities.

The methods of sampling in ecological crimes depend on:

- the goal that is to be achieved;
- the chemical nature of the medium being analyzed;

- the location of the object being analyzed (in addition to the location, the position is also subject to special attention to its close surroundings, due to potential other pollutants that can compromise the real causes and motives of the crime).

The sampling techniques should fulfill the following conditions:

- to be an integral part of an object or system being analyzed;
- not to be contaminated during operation;
- not to compromise or contaminate reagents while handling;
- not to use non-calibrated instruments for sampling;
- not allowing or avoiding change of condition of the samples during conservation and transport(Latifi, L., 2018: 246).

According to the schematic guideline for air sampling after Preliminary Considerations: follows Sampling Procedure and at the end to Overall Procedure. Sampling Procedure contains 5 main point such as: Sampler efficiency, Extraction efficiency (EE), Analytical method recovery (AMR) (through digestion, solubility etc.), Effects of storage and Interferences to the sampling procedure. Overall Procedure contains 5main points also: Detection limit of Overall procedures (Spectroscopic methods, Chromatographic methods etc.), Reliable Quantitation Limit(RQL), Sampling reproducibility, Analytical reproducibility, and Qualitative analysis. After Overall Procedure Preparation of written reports follows. Soil samples should be collected at locations throughout the hot spot site. If possible, these should be randomly selected and equally spaced. However, the presence of notable differences in physical soil qualities (such as staining) may necessitate the preferential selection of a sub-set of sampling locations. Soil samples should be collected using a stainless trowel or shovel, and be collected from the top 10 cm depth (surface soils). Samples will be deposited into a stainless steel tray and will be stirred into a homogenous mixture. Samples will then be placed into one or more 125 ml or 250 ml glass jars. According to the schematic guideline sampling procedure goes as follows: Pre-Sample preparation (identification of sampling site, preparing the jars and the data sheet and the check list), Clean soil sampling equipment (rinsing with water or acetone the equipment and the working gloves), Sampling steps (filing the data sheet and check list with general info, cleaning the equipment, collecting five sub-samples between 1 and 20cm below surface from area 1m x 1m, samples placed on the glass jars and labeling with specific info and at the end the sample storage), and Final check (ensure that the data sheet and has been completed including photos, site map and GPS readings).

When water is sampled, it should be borne in mind that the surface water and drinking water samples are not sampled in the same way, but the touch point may be if the drinking water is taken from surface water-intake in which case a water sample is taken according to the techniques

applicable to surface water prior to intake, and a sample of drainage tap water but with a technically applicable sampling for drinking water. According to (Latifi, L., 2018: 256) standard operating procedures has these main points, but meanwhile the approach must be noted that these standard operating procedure refers to taking representative samples from surface waters (streams, rivers, lakes, wetlands, ponds, small natural water basins, etc.). It covers samples taken from depth as well as from the surface of the water: purpose, scope and tasks, responsibilities, method of work and guidance for the sampling.

The open bottle is dipped below the surface of the water until it reaches a depth of 25 cm. If the water has a small depth, it should be ensured that the sample will not be contaminated by the sediment from the bottom, in most cases the bottle should be filled right up to the top to exclude the presence of air, when the bottle is filled as needed, it is removed from the water and the cover is safely and screwed in. If storage / preserving agents are present, care must be taken that the bottle is not clogged and not to lead to contamination flow of water. The bottle is closed and indicated), Operational technical equipment, Obstacles and potential problems, Sampling procedure or sample, Site selection, Preserving and preserving agents, Decontamination, Safety at work, and finally Quality control.

## **5. FORENSIC ANALYSIS**

During the act of environmental crimes, usually it comes to a certain degree of pollution or environmental damage, with the presence of a certain quantities of harmful substances in the air, water or ground, which amount represents a criminal offense only in such an extent. If this concentration over time is reduced, and the original concentration has not been determined with on-site expertise, there will be no environmental crime. The situational expertise is therefore of utmost importance in these types of crimes, since it sets up the profound: whether there is a crime in this particular case or not. Environmental contamination substances can be quickly dispersed, by evaporation, decomposing or dilution, which significantly can change their concentration, eventually leading to conclusion that environmental crime actually never happened. It is therefore necessary, as soon as possible after the occurrence of the pollution, an expertise to be carried out in order further treatment of this environmental act, as environmental crime (Sazdovska, M. M., 2014).

For each case of pollution of the environment, for which there is reasonable doubt for presence of elements of some of the environmental crimes, planned measures and activities should be taken by the authorities of the Ministry of Interior (MoI) with respect to its clarifying and proof. For this step, forensic experts in various filed (toxicology, biology) may be involved in coordination for the collection of the best traces for further laboratory analysis of the pollutants collected from the crime scene, or other traces of human, animal or plant origin.



In cases where there are no conditions for situational expertise, laboratory analysis on the samples from the contaminated material, and other traces found at the scene must be performed. The technique of detection of evidence and clarification of environmental offenses requires the use of numerous and varied expertise. Depending on the requirements relating to the particular environmental situation, sometimes more expertise in various fields may be required. (Janevski R., Sazdovska, M. M., 2017).

## **6. CONCLUSION**

Environmental forensics is part of the criminalistic techniques, specifically its discipline that develops and applies knowledge, methods and means of detection, investigation and clarification of the disturbance of the environment. In order to determine the current status of all ecosystems, including water and water resources soil and air, it is necessary to perform forensic expertise in the field in order to prove the pollution and detect causes of pollution. Forensic expert's report on water should be part of the review, because it shows the content of pollutants, such are: heavy metals, mineral oils, pesticides and phenols. It is necessary to investigate the transmission and interaction of potential contaminants and the environment and to determine how water, soil and air changing in various places, heights and depths.

Besides the differential method of sampling the water and soil, there is also an integral method. Integrated sampling of water and soil means that from a specific profile, samples are taken and mixed together and an integrated sample of water and soil from a single profile is gained. Such integral sample is representative, but not recommended because the samples lose their individuality. As regarding the air there are only integral method but in that case the method changes and depends from the place of sampling such as: outdoor sampling or indoor sampling.

The authors of the article explain in detail the forensic analysis of environmental crimes such as: processing the scene, the role of the forensic expert, the correctness of the sampling and applying the best techniques and methods for sampling during expertise on environmental crimes, with the ultimate goal such as obtaining sufficient material evidence.

But, the next stage, which is no longer a part of the field of criminalistic techniques, but an integral part of the criminal methods or criminal-operative activity, should determine the offender or the offense. Namely, in the future it is necessary to apply operational tactical measures and investigations from the police broad range of instruments, in order to determine the cause of the pollution. In addition the principle of speed, or cooperativeness should be applied, with timely treatment and detection of perpetrators of environmental crimes or offenses.

## 7. LITERATURE

1. Sazdovska, M. M. (2007). Criminal Situational expertise in practice. Yearbook of the Police Academy in Skopje. Skopje: Police academy
2. Sazdovska, M. M. (2014). Manual on environmental crime investigations. Skopje: Faculty of security.
3. Sazdovska, M. M. (2009). Environmental Criminalistic. Skopje: Solaris Print
4. Janevski R. & Sazdovska M. M. (2017). Forensic analysis for proving of the environmental crimes in Macedonia. International science conference. Security concepts and politics – new generation of risks and threats - V3, Ohrid, 4 and 5 June, UDK:343.23:349.6]:343.148(497.7)
5. Sazdovska M. M., & Oklevski S. (2014) Application of situational analysis during crime scene investigation. Proceedings of the 4th International scientific and professional conference, Police College research days in Zagreb. ISBN 978-953-161-291-6.
6. Murgoski, B. (2011). Reconstruction, Criminalistic expert and Situational expertise during investigation the traffic accident. Skopje: Yearbook Faculty of Security – Skopje.
7. Murgoski, B. (2013). Some current issues relating to evidence and criminalistic processing of the crime scene. Skopje: Faculty of Security – Skopje.
8. Latifi, L. (2018). Situational expertise of surface waters in Republik of Macedonia. PhD Thesis. Faculty of Security - Skopje, University “St. Kliment Ohridski” - Bitola.
9. Latifi, L. & Oklevski, S. (2015). Forensic Aspects of Polluted Waters from Lake Mavrovo. Thematic Conference Proceedings of international Significance “Archibald Reiss Days” V3. Beograd: Academy of Criminalistic and Police Studies.
10. Latifi, L., Sazdovska, M.M. & Troshanski, S. (2015). Forensic of the Pollution of the Waters of Mavrovo Lake. International Scientific Conference. Contemporary Trends in Social Control of Crime. University “St. Kliment Ohridski” – Bitola. Faculty of Security – Skopje.
11. Dzhukleski, G. (2006). Introduction to Criminalistic. Skopje: Grafik Mak Print
12. Sazdovska, M.M & Arminoski, M. (2016). Contemporary criminalistics methods for detection for financial investigations, criminalistics theory and practice god. 3., br. 5., str. 1 - 255, Zagreb,.
13. Vodinelic, V. (1978). Criminalistics. Beograd. Savremena Administracija – Beograd.
14. Saferstain, R. (2010). Criminalistics – Introduction to Forensic. Skopje. Tabernakul – Skopje.
15. Jackson, R.W.A. & Jackson, M.J. (2009). Forensic science. Nampres: Skopje



## SAŽETAK

*U radu Forensic analysis in Environmental Crimes analizira se hitnost forenzičkih ispitivanja na mjestu događaja, odnosno situacijsko vještačenje odgovarajućim alatima i instrumentima korištenim na mjestu događaja. Također, daju se precizne instrukcije o tehnikama, metodama i procedurama o uzorkovanju medija na mjestu događaja, kao što su voda, zrak i tlo, koji završavaju detaljnim analizama u laboratoriju, s krajnjim ciljem osiguravanja materijalnih dokaza za dokazivanje ekološkog krivičnog djela. Objašnjava se i opisuje određivanje dimenzija ekološkog krivičnog djela, uloga forenzičara na mjestu događaja i njegova nadležnost, konzerviranje uzoraka i transport do akreditiranih laboratorija. Objašnjavaju se i daju smjernice i standardne operativne procedure o uzorkovanju medija korak po korak. Na kraju se daju odgovori o počinjenom krivičnom djelu: gdje je djelo izvršeno, vrijeme, motiv i izvršitelj, a sve s ciljem uspješnog suzbijanja ekološkog kriminala.*

*Ključne riječi: ekološki kriminal, istražne mjere, ekspertiza, forenzička analiza, itd.*